

FILE 117

PROPOSAL TO CONDUCT ADDITIONAL RESEARCH ON  
THE EFFECTS OF PHOTOGRAPHIC GROUND RESOLUTION  
ON PHOTOINTERPRETATION  
(GROUND ORDER OF BATTLE TARGETS)



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April 18, 1969

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PROPOSAL TO CONDUCT ADDITIONAL RESEARCH ON  
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ON PHOTOINTERPRETATION

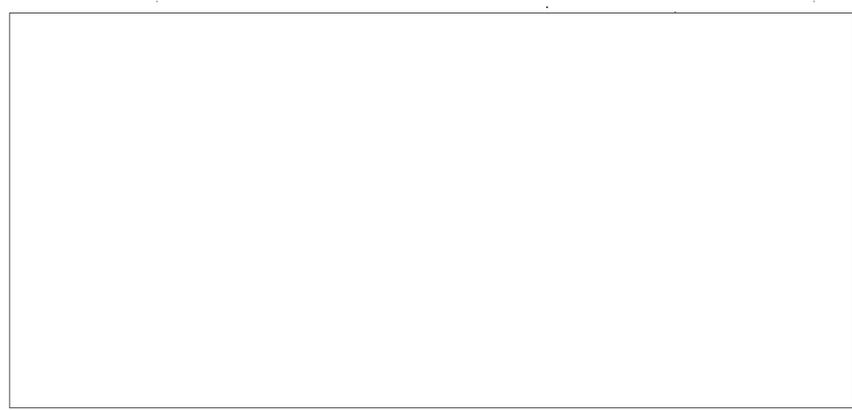
ABSTRACT

This is a proposal to perform the following tasks:

1. To study the effects of photographic ground resolution on the interpretation of military vehicles using scale models as targets, and to relate the results of the study to the results of a line-scan image interpretation study of the same targets which was recently completed
2. To obtain and prepare materials for a study of the effects of ground resolution on the interpretation of ground forces using real ground force equipment as targets.

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It is estimated that the costs will be as follows:



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INTRODUCTION

This is a proposal to extend the scope of work being conducted under Contract  to include a study of the effects of variations in photographic ground resolution on the interpretation of ground-order-of-battle targets.

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Modern photographic reconnaissance systems are enormously expensive, and the attainment of better ground resolutions implies greater expense. The relation between resolution and expense probably is not a linear one; improving ground resolution by a factor of two, for example, probably means an increase in system expense by much more than a factor of two. Furthermore, improvements in ground resolution may imply a decrease in area coverage.

For these reasons the intelligence community should continue the effort to determine what additional significant intelligence information is obtained with improvements in ground resolution. Such knowledge is vital to the evaluation of proposed systems.

No one has yet been able to develop an objective relation between intelligence information and dollars. For one reason, the value of intelligence information varies over time and it is difficult, if not impossible, to foresee entirely what information will be valuable in the future. Nevertheless, the effort to determine what information better ground resolutions permit the photointerpreter to obtain should continue, so as to provide the people responsible for designing and evaluating systems with an additional source of relevant data.

Thus far two studies of the effects of ground resolution on the interpretation of targets have been completed. The targets in the first were domestic, offensive ICBM sites; the targets in the second were scale models of mobile radars. Technical reports describing these studies have been submitted to the sponsor. In addition briefings on them have been given both to the sponsor and to other organizations in the intelligence community.

Offensive missile targets were selected for the first study because of their significance to the intelligence community. The results showed that because of their relatively simple external configurations "very good" ground resolutions were not required to exploit fully the intelligence in overhead photographs of them.<sup>1</sup>

The fact was recognized then, and still is, that the effects of ground resolution on interpretation is "target specific". That is, one class of targets requires better ground resolution than another for the complete exploitation of overhead photography.

For that reason a similar study was done with mobile radars serving as targets. They were selected because of the greater detail visible in their external configurations -- the antennas, horns, feeder lines, and so on. The results showed that significantly better ground resolutions are required for radars than for missile sites to exploit fully the intelligence in overhead photography.

It has been suggested that ground forces as a class of targets might require even better ground resolutions than radars for the complete exploitation of photography. Therefore, it is proposed that additional studies similar to the missile and radar studies be conducted with ground equipment as the targets; more specifically, it is proposed that two studies be done in the following two phases:

Phase I:

Ia. A study of the effects of ground resolution on the interpretation of military vehicles using scale models as targets (the "model" study).

<sup>1</sup>. The specific results are not presented because of security.

Ib. The preparation of materials for a study of the effects of ground resolution on the interpretation of ground forces using real ground force equipment and personnel as targets (the "field" study).

Phase II: Execution of the field study

This proposal is to conduct Phase I only.

#### TECHNICAL DISCUSSION

It is proposed that Phase Ia, a study be conducted to determine the effects of ground resolution in six steps on the interpretation of scale models of military vehicles. The interpretation task will include target classification (for example: tank or truck?) and target identification (for example: tank type A or tank type B?). The photointerpreters' (P.I.s') task will be to match photographs of the models with the models themselves which will be placed in front of them. In that sense, the task will be similar to the operational task of matching a photograph of a target with a target shown in a P.I. key or in collateral sources such as ground photography.

[redacted] recently completed a study of line-scan imagery using the aforementioned models of military vehicles as targets. The original negative photograph used to produce the line-scan imagery for that study would be used to produce GEMS<sup>2</sup> (photographs produced to simulate carefully specified modulation transfer functions) for the model study proposed here. That photograph was made under nearly optimum conditions of contrast and shadow definition. This fact plus the nature of the task to be given

2. See previous [redacted] reports.

the P.I.'s -- comparing the photographs with the actual models -- will lead to results showing the poorest ground resolution at which military vehicles can be classified and identified at any specified degree of accuracy. Such results should have practical implications for mission planning and system design requirements. And for the purposes of the research proposed here, they will aid in determining the limits of ground resolution that should be used in the subsequent field study. They will also permit the development of empirical relations between photographic and line-scan image interpretation. The latter point is significant because of the likely increase in the use of line-scan images (and real-time interpretation) and the desirability of applying the data available on photointerpretation to line-scan image interpretation.

It is proposed that in Phase Ib, preparations be made to perform an experimental study of the effects of ground resolution using photographs of real, domestic ground force targets. Technical discussions of the purposes and methods of such a study are given in the missile and radar study reports and so will not be repeated here.

#### WORK STATEMENT

In Phase Ia, the model study, the following tasks would be performed:

- Task 1. Preparation of photographic stimulus materials (GEMS) and computation of associated modulation transfer functions.
- Task 2. Development of the experimental design, instructions, and P.I. response recording method.
- Task 3. Selection of experimental subjects and collection of experimental data.

Task 4. Analysis of data.

Task 5. Preparation of the technical report and briefing.

In Phase Ib, preparation for the field study, the following tasks would be performed:

Task 1. Selection and procurement of the required aircraft and camera.

Task 2. Selection, procurement, and placement of appropriate targets.

Task 3. Construction or procurement and placement of test targets.

Task 4. Collection of "ground truth" information.

Task 5. Collection of photography.

[ ] cannot take the entire responsibility for the successful performance of these tasks in Phase Ib. Successful performance of them will require support from the sponsor [ ]

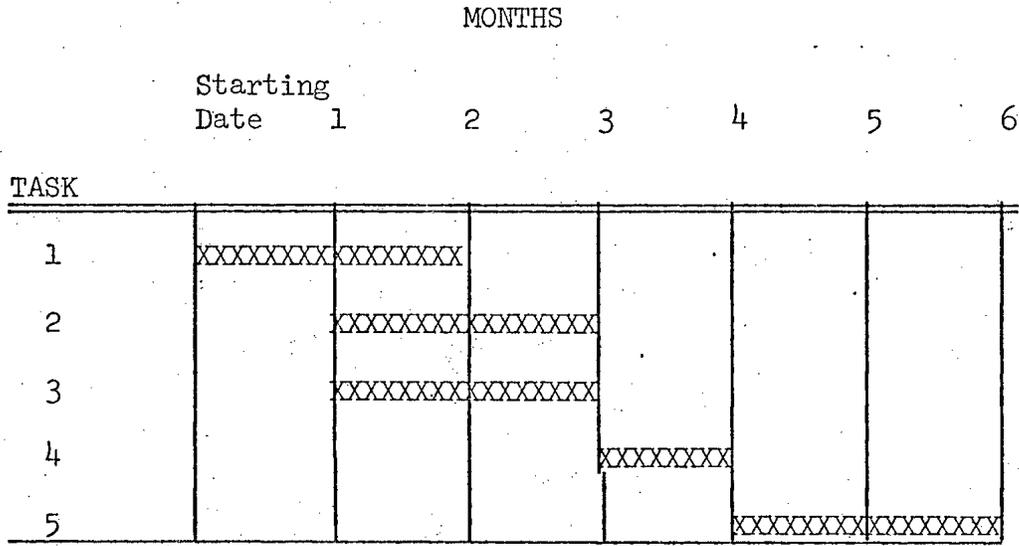
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SCHEDULES

TASK	MONTHS			
	Starting Date	1	2	3
1		XXXXXXXXXXXXXXXXXXXX		
2	XXXXXX			
3		XXXXXXXXXX		
4			XXXXXXXXXXXXXXXXXXXX	
5				XXXXXXXXXXXXXXXXXXXX

Phase Ia: The Model Study



Phase Ib: Preparation for the Field Study

EXPENDITURE RATE

It is expected that the expenditure rate will be approximately

a linear projection.

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COMMENT ON SCHEDULES AND EXPENDITURE RATE

It should be recognized that this proposal is to conduct applied research in an operational environment. The work must be done on a not-to-interfere basis, and the contractor is dependent in many ways on the support of the sponsor. Furthermore, if they are going to be most productive, applied as well as basic research scientists must be responsive to unexpected problems or discoveries. Consequently, the Schedules and Expenditure Rate proposed are rough estimates.

DELIVERABLE ITEMS

Technical reports will be submitted at the completion of each study. Briefings describing the results of the work will be given at the request of the sponsor.

Progress reports will be given to the sponsor orally at least every month. Written progress reports will be submitted at the request of the sponsor.

A summary report will be submitted at the conclusion of the contract.

GOVERNMENT FURNISHED EQUIPMENT

For the acquisition of certain data and material under this contract, the sponsor will assist in arranging for the use of Government facilities and equipment.

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The research work will be conducted by [REDACTED]

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[REDACTED] It is anticipated that [REDACTED]

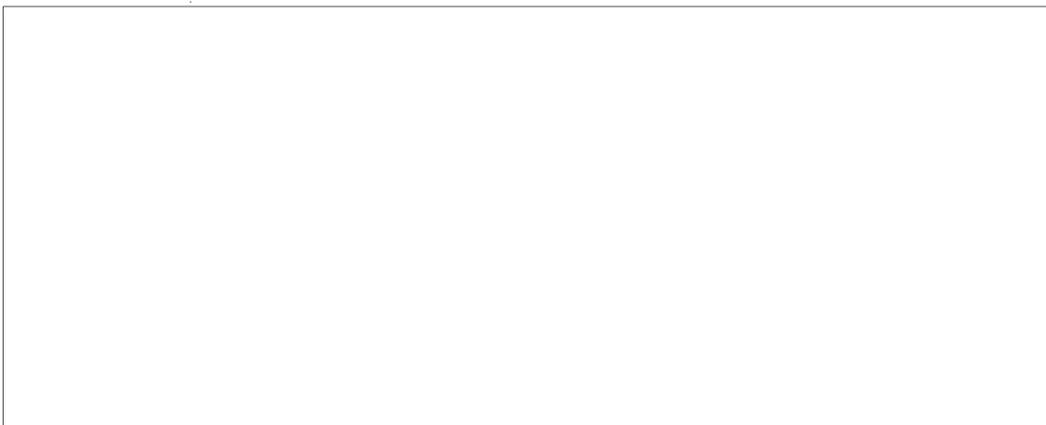
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[REDACTED] will assist in some phases of the work.

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NOTES

1. The overhead rate shown in this proposal is a bidding rate. Overhead is allocated to contracts on the basis of a rate derived from actual overhead expenses allowable under cost-type contracts in accordance with ASPR XV, and is audited each calendar year by the Defense Contract Audit Agency, 11099 La Cienega Boulevard, Los Angeles, California 90045.
2. Bidder is not dominant in its field of operation and with affiliates employs fewer than 500 employees.
3. The prices of the items covered do not exceed those paid by any other purchaser from the contractor and the Government is placed in the most favored price category.
4. Prices are based on straight time.
5. Bidder represents that he has not employed or retained a company or person (other than a full-time employee) to solicit or secure this contract and agrees to furnish information thereto as requested by the Contracting Officer.
6. Bidder is incorporated in the State of Nevada.
7. Bidder is a profit institution as determined by the Bureau of Internal Revenue.



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April 15, 1969

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